OLDMAN RIVER DAM

1989 RAPTOR MITIGATION PROGRAM

A Report Prepared For:

GOVERNMENT OF THE PROVINCE OF ALBERTA

DEPARTMENT OF PUBLIC WORKS, SUPPLY AND SERVICES

Edmonton, Alberta

Prepared by

R.W. FYFE

JANUARY, 1990

Table of Contents

93-02246/

List of Tables.....ii

List of Appendices.....iii

Executive Summary.....iv

1.0 Introduction.....1

1.1 Background and Rationale.....1

2.0 Objectives.....2

3.0 Methods.....3

3.1 Field Observations.....3

3.1.1 Inventory of breeding pairs.....3

3.1.2 Banding and Color Marking.....3

3.1.3 Disturbance.....4

3.1.4 Artificial Nest Construction.....4

4.0 Results and Discussion.....5

4.1 Population Inventory.....5

4.1.1 Prairie Falcon Production.....6

4.1.2 Ferruginous Hawk Production.....7

4.2 Banding and Color Marking.....8

4.3 Disturbance.....9

4.4 Artificial Nest Construction.....13

5.0 Discussion.....14

6.0 Recommendations.....17

7.0 Literature Cited.....18

8.0 Acknowledgements.....19

Appendices.....20

List of Tables

TABLE 1. PRAIRIE FALCON BREEDING TERRITORIES.....6

TABLE 2. FERRUGINOUS HAWK BREEDING TERRITORIES.....7

TABLE 3. ADULT PRAIRIE FALCON BANDING.....8

TABLE 4. YOUNG PRAIRIE FALCON BANDING.....9

TABLE 5. PRODUCTIVITY AND DISTURBANCE OF TERRITORIAL PAIRS OF FERRUGINOUS HAWKS.....12

TABLE 6. PRODUCTIVITY AND DISTURBANCE OF TERRITORIAL PAIRS OF PRAIRIE FALCONS.....12

List of Appendices

APPENDIX 1. Nest Site Records.....20

APPENDIX 2. Recorded Migrant Arrival Dates.....28

APPENDIX 3. Definitions of Terms used in Report.....29

EXECUTIVE SUMMARY

This project was implemented in response to concerns relative to the documented sensitivity of two species of raptorial birds the Prairie Falcons Falco mexicanus and Ferruginous Hawks Buteo regalis. Both species are present and nest in areas impacted by the construction and eventual flooding of the Oldman River Dam. I was retained by Alberta Public Works, Supply and Services to monitor the effects of project related activities on these birds, and to supervise specific mitigation procedures with respect to these two species.

Approximately 550 hours were spent in the field observing these birds. Fifteen Prairie Falcon and three Ferruginous Hawk breeding territories were located and monitored throughout the 1989 breeding season. Nine pair of falcons produced thirty one young and one pair of hawks produced three young. Thirteen adult and thirty one young Prairie Falcons were caught, individually banded and color marked for future identification. Moderate to severe disturbance associated with construction related activities was documented at eight of the falcon territories. Two pair of the birds subjected to severe disturbance early in the breeding cycle made no nesting attempt.

Three of fifteen artificial nest sites constructed prior to the breeding season were successfully utilized by Prairie Falcons, Canada Geese and Ravens. Twenty nine additional sites were constructed following the breeding season. These sites have been

designed to serve as alternate nest locations and have been constructed to provide nest sites for birds that may be forced from current territories by construction or flooding.

1.0. INTRODUCTION

Background and Rationale

The population of Prairie Falcons and Ferruginous Hawks breeding along the Oldman River has been monitored most years from the late 1960's through the early 1980's. (CWS files) This population was again monitored by Young in 1985, 1986, and 1987 (Young et al. 1986.,Young 1988). Five pair of Prairie Falcons and one pair of Ferruginous Hawk were found to be still occupying nesting territories first documented in the late 1960's.

In order to understand the affects of construction and the subsequent flooding on this population of birds of prey, it is necessary to determine the following:

a) current breeding population of both species,

b) where possible to document disturbance associated with construction of the dam and its affect on territorial pairs,

c) to individually mark resident birds of both species for future identification, specifically to determine movement and possible relocations associated with the construction and flooding of the dam,

d) to document annual production prior to and subsequent to the completion of the dam.

The most recent data indicates that the construction and subsequent flooding of the Oldman River Dam apparently will eliminate available nesting habitat for six pair of Prairie Falcons and one pair of Ferruginous Hawks presently nesting in, or adjacent to the area to be flooded by the completed Dam.

Since construction and flooding will displace breeding pairs of Prairie Falcon and Ferruginous Hawks the population can

only be maintained by implementing specific mitigation procedures. As the principal concern is the loss of nest sites, initial mitigation must include the provision of suitable alternate nest sites in areas not currently occupied by territorial pairs of these two species. These must be located in areas that will not be flooded and which will provide access to sufficient foraging habitat to support each breeding pair. It is also desirable to initiate and maintain good public relations and where possible to encourage direct public involvement in activities related to the projects.

2.0 OBJECTIVES

The overall objective of the project has been to minimize possible adverse effects of the construction and subsequent flooding of the Oldman River Dam on the resident populations of Prairie Falcons and Ferruginous Hawks. To achieve this objective we are documenting the effect of construction activities and we have implemented mitigation procedures which we believe will minimize the impact of the construction and flooding on these populations.

Specific objectives as described in the agreement # Fyf 89-01 were as follows:

a) To provide supervisory services relative to the construction of raptor nesting sites,

b) To supervise the tagging and identification of raptors during the year,

c) To maintain a photographic (slide) record of the project,

d) To observe and record the movement of raptors during the courtship period and over the summer, and,

e) To provide a report at the end of the year.

3.0 METHODS

3.1 FIELD OBSERVATIONS:

3.1.1 Inventory of Breeding Pairs

An inventory of breeding pairs was carried out in 1986 and again in 1987. These inventories were somewhat limited in that they apparently were restricted to nests located within 1.6 km of construction related activity (Young, 1988). However, clearly a more comprehensive inventory was required in order to determine the total population, the affect of construction and flooding of the dam, and to locate potential alternate breeding locations. Therefore, beginning in March 1989 a more comprehensive inventory was implemented. Field investigations were carried out to locate breeding pairs, non breeding pairs and individuals occupying known breeding territories, or suitable nesting habitat within 16 km. of the construction area.

3.1.2 Banding and Color Marking

In order to verify the effects of the construction and/or flooding of the dam on the resident birds, it will be necessary to be able to distinguish residents from migrants or transients of the same species. Since most individuals of both species are virtually identical in size and color it is necessary to catch the individuals and to mark them with an external marking device which can be identified later. Following considerable discussion we received permission from Alberta Fish and Wildlife Branch and from the Canadian Wildlife Service Banding Office to use standard numbered bands together

with combinations of red, blue and black colored bands on Prairie Falcons from the study area.

It was also proposed that Ferruginous Hawks will be individually marked beginning in 1990.

3.1.3 Disturbance

Earlier studies have documented adverse affects on breeding Prairie Falcons and Ferruginous Hawks resulting from various types of disturbance (Fyfe and Olendorff, 1976, Grier and Fyfe, 1987). Since several of the nesting territories encompass areas that are impacted by or adjacent to the dam it is inevitable that resident birds will be disturbed by activities associated with construction and/or flooding. Since one of the objectives of the current study is to determine the effects of the construction and flooding of the dam on these two species, all observed instances of disturbance during the breeding season were documented.

3.1.4 Artificial Nest Construction

A minimum of six nesting territories will be adversely impacted as a result of dam construction and /or flooding. These pairs will suffer loss of nesting and/or foraging habitat or will be severely subjected to human interference. Any of these factors in turn may result directly or indirectly in the desertion of nest sites or breeding territories. Field observations suggest that foraging areas and availability of an adequate prey base do not appear to be limiting factors. Suitable nesting

habitat is also available, however, suitable nest sites are limited or non existent. Consequently if birds are displaced due to construction or flooding they would either have to displace other breeding pairs, remain as non breeding adults or simply leave the area. In order to protect and maintain these birds it was essential to investigate all potential nesting habitat and to create suitable nest sites in those areas where they were inadequate or absent. Once sites were selected renovation was carried out prior to, and following the breeding season to minimize disturbance to the resident breeding population.

4.0 RESULTS AND DISCUSSION

4.1 POPULATION INVENTORY

Birds were located at a total of fifteen Prairie Falcon and three Ferruginous Hawk nesting territories in the study area (Figure 1). Six of the Prairie Falcon and one Ferruginous Hawk nesting territories apparently were documented for the first time or not included in earlier inventories. All sites were located within the reservoir or within 16 km of F.S.L. Pairs of birds and courtship behaviour patterns were observed at fourteen Prairie Falcon sites and at the three Ferruginous Hawk sites. A single territorial female was observed at one site (Table 1). A single female was also observed at another site at the end of the breeding season and may indicate the establishment of another territory in future years.

4.1.1 Prairie Falcon Production

Thirty one young were produced by nine productive pair (Table 1). for an average of 3.44 young per productive pair, or an average of 2.58 young for twelve nesting attempts. As far as I could determine three pair did not attempt to nest. Copulation was observed in one of these pair, courtship behaviour was observed between the birds in the pair in the second territory and a lone territorial female was observed in the third territory.

TABLE 1.

PRAIRIE FALCON BREEDING TERRITORIES

NEST SITE	#	PRS	IND	COURT	COP	EGGS	YNG	FLEDGED
Old Bridge	#48	Y		Y	Y			
Mercury	#45	Y		Y			4	4
Dam[1]	#42	Y		Y				
Buffalo Jump E.	#40	Y		Y	Y		4	4
Buffalo Jump W.		Y		Y	Y	3		
Fairbrother		Y		Y		5	3	3
Bitango Bridge	#37	Y		Y			5	5
Tennessee Creek		N	Y					
Lang		Y		Y	Y	3	1	1
Welsch	#22	Y		Y			4	4
Day		Y		Y	Y	5	3	2
Double Ox-Bow	#18	Y		Y				
Castle Dairy		Y		Y	Y	5	4	4
Maloff	#12	Y		Y	Y	4	1	
Horseshoe Canyon	#15	Y		Y		5	4	4
(Stevick			Y)[2]					

[1] suspected relocation of same pair of birds
[2] a lone female observed after the breeding season at an artificial hole

NEST SITE = Names given to all Territorial Pairs
# = Corresponds to nest numbers given in earlier reports by Young
PRS = pairs observed on territory
IND = individual birds observed to remain in a territory
COURT = courtship behaviour observed
COP = copulation observed
EGG = number of eggs observed, most nests not climbed in incubation
YNG = number of young observed at first climbing
FLEDGED = number of young known to have fledged

4.1.2 Ferruginous Hawk Production

Three young were observed in one nest site just prior to fledging, the remaining two pair of Ferruginous Hawks were unsuccessful. The Porcupine Hill pair were observed courting, nest building, breeding and incubating but deserted following an unusually heavy snow fall May 27th. The Feedlot Pair were observed copulating but did not lay eggs and although they were observed in the area during the summer there was no further indication of a breeding attempt.

TABLE 2.

FERRUGINOUS HAWK BREEDING TERRITORIES

NEST SITE	#	PRS	IND	COURT	COP	EGGS	YNG	FLEDGED
Feedlot[1]		Y		Y	Y			
Highway[2]	#47	Y		Y	Y			3
Porcupine Hill[3]		Y		Y	Y	3		

[1] this pair did not lay eggs
[2] suspect relocation of this pair to the south
[3] this pair deserted after the heavy snowstorm May

NEST SITE = Names given to all Territorial Pairs
# = Corresponds to nest numbers given in earlier reports by Young
PRS = pairs observed on territory
IND = individual birds observed to remain in a territory
COURT = courtship behaviour observed
COP = copulation observed
EGG = number of eggs observed, most nests not climbed in incubation
YNG = number of young observed at first climbing
FLEDGED = number of young known to have fledged

4.2 BANDING AND COLOR MARKING

Thirteen breeding adults (Table 3.) and all of the thirty one young Prairie Falcons (Table 4.) that were fledged during the 1989 breeding season were caught, banded and color marked. Each bird was banded with a numbered USF&W band and with one or more colored anodized aluminum bands. The USF&W bands that were used are the standard silver colored aluminum lock-on bands issued by the Canadian Wildlife Service, whereas the Red, Blue and Black anodized bands were produced in Edmonton. These were rivetted bands and came as both large numbered bands and as small plain bands. All of the bands were used in specific color combinations so that later we may be able to identify some of the birds in the field by the use of spotting scopes. Since we are concerned to be able to locate individuals of the breeding population that move or are displaced the adults were all marked with individual color coding. However since the young will not

TABLE 3.

ADULT PRAIRIE FALCON BANDING 1989

Location	Males Banded		Females Banded	
	Left	Right	Left	Right
E. Buffalo Jump	Red 1	816-80801		
Bitango Bridge			Red 5	987-85501+sm blue
Maloff	Red 3	816-80802+sm.red		
Lang's			Blue 4	987-85502
Welsch's	Blue 2	816-80803+sm.blue	Blue 5	987-85503+sm blue
Day's	Black 3	816-80804+sm.red		
Double Ox-Bow			Black 4	987-85504
Fairbrother's	Black 2	816-80805+sm.blue	Black 5	987-85505+sm blue
Mercury	Black 1	816-80806+sm.red	Black 6	987-85506+sm red
Castle Dairy		816-80807+sm.red		

be part of the breeding cohort prior to the flooding of the dam they have only been color coded as to the year of production so that we can determine if recruitment is from this population unit.

TABLE 4.

YOUNG PRAIRIE FALCON BANDING 1989

Location	Males Banded		Females Banded	
	Left	Right	Left	Right
Bitango Bridge			987-85510	Red 03-sm black
Bitango Bridge	816-80809	Red 35 - sm black		
Bitango Bridge	816-80810	Red 36 - sm black		
Bitango Bridge	816-80811	Red 37 - sm black		
Bitango Bridge	816-80812	Red 38 - sm black		
Castle Dairy			987-85522	Red 33-black
Castle Dairy			987-85524	Red 32-black
Castle Dairy	816-80820	Red 47 - sm black		
Castle Dairy	816-80821	Red 46 - sm black		
Day's			987-85517	Red 11-sm black
Day's			987-85518	Red 12-sm black
Double Ox-Bow				
E. Buffalo Jump			987-85519	Red 13-sm black
E. Buffalo Jump			987-85520	Red 14-sm black
E. Buffalo Jump	816-80818	Red 44 - sm black		
E. Buffalo Jump	816-80819	Red 45 - sm black		
Fairbrother's			987-85516	Red 09-sm black
Fairbrother's	816-80816	Red 42 - sm black		
Fairbrother's	816-80817	Red 43 - sm black		
Horse-shoe Canyon			987-85507	Red 00-sm black
Horse-shoe Canyon			987-85508	Red 01-sm black
Horse-shoe Canyon			987-85509	Red 02-sm black
Horse-shoe Canyon	816-80808	Red 34 - sm black		
Lang's	816-80822	Red 48 - sm black		
Maloff				
Mercury			987-85514	Red 07-sm black
Mercury			987-85515	Red 08-sm black
Mercury	816-80814	Red 40 - sm black		
Mercury	816-80815	Red 41 - sm black		
Welsch's			987-85511	Red 04-sm black
Welsch's			987-85512	Red 05-sm black
Welsch's			987-85513	Red 06-sm black
Welsch's	816-80813	Red 39 - sm black		

4.3 DISTURBANCE

Disturbance is defined as something which disrupts or destroys the peace. In reference to breeding birds disturbance would be any activity which disrupts the breeding cycle. The level of

disturbance is very difficult to measure since there is a marked difference in tolerance levels of species and of individuals. This is further complicated by habituation defined as "the waning of a response to a repeated activity" (Marler and Hamilton, 1966) or in this application, the ability of individuals and/or pairs to accept disturbance as a result of increased exposure to an activity which does not harm or threaten the individual or pair. Desertion of a territory by a breeding pair of birds can result from the actual physical destruction of a nesting site or as a result of severe disturbance of pairs or individuals during the breeding season. Our concerns in relation to the dam rest primarily with two species, the Ferruginous Hawk which is extremely sensitive to disturbance (Fyfe and Olendorff,1976) and, the Prairie Falcon which is relatively tolerant to most types of disturbance (Holthuijzen, 1989) . It was not possible to quantify the disturbance site by site, however, for the sake of discussion and comparison I will refer to disturbance as minimal, moderate, high and severe.

Examples of minimal disturbance would include the incidental transgression of any predator, human,or vehicle into the territory of a breeding pair which may or may not elicit a territorial response. In such an instance, a pair would return to normal behaviour as soon as the transgression ceased. Moderate disturbance would include frequent transgression of a predator, vehicle, activity or humans in the territory of a breeding pair but at a sufficient distance from the nest site would not constitute a threat. High disturbance is excessive disturbance which in my opinion would normally result in the desertion of a nest site for a given breeding season but which are tolerated either as a result of habituation or because the activity has occurred relatively late in the breeding cycle. Examples of high disturbance include

extensive heavy equipment activity and/or human activity up to about 150m of the nest site during incubation or the rearing of young. Severe disturbance includes any activity which is threatening early in the breeding cycle. In particular during courtship and nest site selection. Examples would include physical alteration of the nesting cliff, excessive human activity within 150m of the cliff and/or direct predation or visitation to the nest site by a predator or human.

All breeding pairs of both species are subject to disturbance. My observations suggest that all three of the more sensitive Ferruginous pairs were exposed to minimal disturbance. Of the three pair , one pair did not attempt to nest, one pair deserted following a heavy off season snow fall and the third pair were successful. In contrast, several pair of the Prairie Falcons were subject to much more intense disturbance. Three pair, were subject to moderate disturbance, three to high disturbance and two pairs to severe levels of disturbance. The latter deserted their nest sites and did not attempt to nest. In addition to the above, three pair failed to produce young. One pair may have failed as a result of disturbance combined with extreme weather conditions. A second pair failed for no apparent reason and a third territory was located too late in the season to determine the cause of the failed attempt. While in this instance I cannot be certain that a nesting attempt was made, it is likely since the resident bird was defensive at the nest, and was observed returning to the site as soon as we had moved to a safe distance.

TABLE 5.

PRODUCTIVITY AND DISTURBANCE OF TERRITORIAL PAIRS OF FERRUGINOUS HAWKS

NEST SITE	#	PROD	DISTURBANCE
Feedlot		N	Minimal
Highway	#47	Y	Minimal
Porcupine Hill		N	Minimal

NEST SITE = Names given to all Territorial Pairs
= = Corresponds to nest numbers given in earlier reports by Young
PROD = Indicates whether a nest site was productive or not
DISTURBANCE = relative level of documented disturbance

TABLE 6.

PRODUCTIVITY AND DISTURBANCE OF TERRITORIAL PAIRS OF PRAIRIE FALCONS

NEST SITE	#	PROD	DISTURBANCE
Old Bridge	#48	N	Severe
Mercury	#45	Y	High
Dam	#42	N	Severe
Buffalo Jump E.	#40	Y	Minimal
Buffalo Jump W.		N	Minimal
Fairbrother		Y	Minimal
Bitango Bridge	#37	Y	High
Tennessee Creek		Y	Unknown
Lang		Y	Moderate
Welsch	#22	Y	High
Day		Y	Minimal
Double Ox-Bow	#18	N	Minimal
Castle Dairy		Y	Moderate
Maloff	#12	N	Moderate
Horseshoe Canyon	#15	Y	Minimal

NEST SITE = Names given to all Territorial Pairs
= = Corresponds to nest numbers given in earlier reports by Young
PROD = Indicates whether a nest site was productive or not
DISTURBANCE = relative level of documented disturbance

4.4 ARTIFICIAL NEST CONSTRUCTION

Visits to study area in the fall of 1988 identified the presence of many areas of suitable Prairie Falcon nesting habitat without acceptable nesting sites. However, it was clear that most of these locations would provide suitable nest locations with some modification to the existing cliff faces either in the form of simple renovation or actual nest hole construction. It was recognized that such modification would provide potential nest sites not only for the falcons but also might be used as nest sites for other raptors, Canada Geese and Ravens (Fyfe and Armbruster,1977). The first attempts at modification were carried out in the winter of 88/89. A total of fifteen holes were modified or made prior to the breeding season. All of these were suitable although in general perhaps a little larger than required. Three of the fifteen artificial holes were utilized during the 1989 breeding season, one by ravens, one by Canada Geese and one by Prairie Falcons. One other site apparently attracted a pair of Prairie Falcons which was observed investigating the site and then decided to nest about 50m away on an open ledge. Two other sites were investigated by falcons, one near camp attracted a migrant peregrine and another near Stevick's farm attracted a female Prairie Falcon late in the breeding season.

Throughout the breeding season potential nest sites which could be modified to provide suitable nest sites were noted. Following the breeding season these sites were visited and a total of twenty nine additional nest sites were created in areas that will not be flooded by the dam. In this manner with the possible exception of the Bitango Bridge and Tennessee Creek territories, suitable alternate nest sites are available in relatively close proximity to the existing sites which will be lost due to flooding.

All activities were recorded in detail and a photographic record was

completed and turned over to Alberta Public Works, Supply and Services.

5.0 DISCUSSION

The total of fifteen territorial pair of Prairie Falcons and three territorial pair of Ferruginous Hawks were located during the 1989 breeding season. This number was greater than previously recorded and suggests a rather remarkable recovery from the recorded five pair located in the late 1960's. The large number of breeding pairs together with the excellent production of the successful pairs further suggests an excellent food supply that is readily available to these birds. Although no attempt has been made to quantify the food supply, it is apparent that there is a very high ground squirrel population.

The average production of 3.44 young per successful pair is excellent and compares favourably with production in other Prairie falcon populations(Fyfe et al.,1969; Ogden, 1973; Olendorff, 1973). In fact when the very unusual and frequently adverse weather conditions are taken into account, the production was exceptional.

The trapping and marking of the adults and young was successful with all of the fledged young, about 50% of the breeding adults caught and banded. However, trapping of the adults was hampered by unseasonably cold weather and trapping was terminated rather than subject small young or eggs to undue chilling. With better weather conditions every effort will be made in 1990 to trap the remaining breeding cohort.

All of the birds were ringed with standard USF&W bands for positive individual identification and red, blue or black anodized bands to aid in field identification. The USF&W band was placed on the right leg of adults and on the left leg of the young. Whereas the adults were individually color marked the color marking of the young was

standardized for the year. This will vary each year for the next two years. In this manner we should meet our objective of being able to identify the individual breeding adults and therefore be able to determine their movements within the population. Similarly through the marking of the young we should be able to determine whether new birds in the population are recruitments from young produced in the area or from other populations.

Next to the actual destruction of nest sites by flooding, the most serious problem for both the Prairie Falcon and the Ferruginous Hawks is the incredible amount of disturbance resulting from the construction of the dam, roads, clearing and habitat modification. The most remarkable aspect of the project has been the extent of the habituation and tolerance of the Prairie Falcons to the many types of disturbance that were documented. Many of these birds demonstrated tolerance levels to human activity far in excess to anything I have witnessed or would have believed after close to forty years of work with this species. It is obvious that Prairie Falcons will tolerate incredible disturbance once incubation is well underway and also that they can be habituated to a wide variety of human activities. The two desertions which were documented and which may be attributed to disturbance resulted from similar activity. Both sites were deserted very early in the breeding cycle at the time when the pairs were selecting nest sites and had not yet begun egg laying. Both sites were disturbed for several days in succession, and both had workmen walking about within 100M of the nest sites for extended periods of time.

The potential of artificial nest holes was amply demonstrated when three of the fifteen holes constructed prior to the breeding season were occupied by three different species during the current breeding season. No additional construction was initiated during the breeding season

however, suitable nesting habitat was assessed with the object of creating alternate nest sites in areas where breeding pairs would be displaced with the flooding of the dam. Where possible, alternate sites were first selected in or adjacent to current breeding territories. Additional sites were then selected within the arbitrary 16 km zone adjacent to the future reservoir. Following the breeding season twenty nine additional nest sites were created. Suitable alternate nest sites are now available for all of the pairs the exception of those at Bitango Bridge and Tennessee Creek. Suitable nesting habitat is limited in or adjacent to these territories and further investigations will have to be made to see if alternate sites are feasible.

6.0 RECOMMENDATIONS

1. Where possible, it would be desirable to coordinate construction activities within 1 km of nest sites so as to minimize disturbance and avoid potential desertion of breeding pairs of both Prairie Falcons and Ferruginous Hawks.

2. Intensive field investigations documenting disturbance, nesting attempts and production by breeding pairs together with the marking of adults and young should be continued during 1990 and 1991. This should then be gradually phased down during the next three years to a simply annual monitoring of the occupancy by breeding pairs and banding of the young to determine production. At this point the responsibility for subsequent monitoring should be transferred to the Fish and Wildlife Division.

3. I recommend the establishment of information centres or displays in Pincher Creek, Cowley, and at the camp to inform the public and workers of the raptor and wildlife mitigation work that is being carried out in association with the dam.

4. I recommend the establishment of an observation shelter and information board opposite the Mercury site so that the public can observe the Prairie Falcons through spotting scopes. This should be manned by a summer student.

7.0 LITERATURE CITED

Fyfe, R.W., Campbell, J., Haysom, B.,and Hodson, K. 1969. Regional population declines and organochlorine insecticides in Canadian prairie falcons. Can Field-Nat 83: 191-200.

Fyfe, R.W. & Armbruster, H. 1977 Raptor research and management in Canada. Proc. ICBP World Conf. on birds of prey, Vienna, 1975: 282-293.

Fyfe, R.W. and R. Olendorff. 1976. Minimizing the Dangers of Nesting Studies to Raptors and other Sensitive Species. CWS Occasional Paper Number 23. 17pp.

Grier, J.W. and R.W. Fyfe 1985. Preventing Research and Management Disturbance. pp. 173-182. In Millsap, B.A., K.W. Cline, B.A. Giron Pendleton and D.M. Bird (eds). Raptor Management Techniques Manual. National Wildlife Federation Washington. 419pp.

Holthuijzen M. A., 1989. Behaviour and Productivity of Nesting Prairie Falcons in Relation to Construction Activities at Swan Falls Dam. Final Report. Idaho Power Co., Boise, Idaho. 77pp.

Marler, P. R., and W. J. Hamilton. 1966. Mechanisms of Animal Behaviour. John Wiley and Sons, Inc. New York, N.Y. 171pp.

Ogden, Verland T. 1973. Nesting Density and Reproductive Success of the Prairie Falcon in Southwestern Idaho. M.S. Thesis, University of Idaho, Moscow, Idaho. 43pp

Olendorff, Richard R., 1973. The Ecology of Nesting Birds of Prey in Northwestern Colorado. Grassland Biome Ecosystem Analysis Studies. U.S. International Biological Program. Technical Report No. 211. Colorado State University, Fort Collins, Colorado, 233pp.

Young, D.A., D.A. Weidl, 1.M. Allison and H.J. Russell. 1986. Oldman River Wildlife Investigations - Spring and Summer, 1895. Prep. for The Delta Environmental Management Group Ltd. The Alberta Environment, Planning Division of Environmental Management Associates and Salix Enterprises Ltd. 92pp and App.

Young, D.A. 1988. A Monitoring Program to Evaluate the Effects of Oldman River Dam Construction Activities on Nesting Raptors. Prep. The Alberta Environment, Planning Division, Environmental Management Associates Ltd. 21 pp.

8.0 ACKNOWLEDGEMENTS

I would like to acknowledge the assistance and contributions of Peter Harvey and Peter Charkiw in the banding, color marking and nest hole construction; of my wife Lorraine as a field assistant and typist; also I thank Dave Hay and Al Nilson for their patience and assistance in providing the support necessary to get the job done.

APPENDIX 1.

NEST SITE RECORDS PRAIRIE FALCONS

Old Bridge Nest Site. #48(Young et al.,1986)

History
This is one of the original nest sites documented in the late 1960's and monitored by CWS through the early 1980's. The nest was reported to be occupied in 1986 and 1987 (Young, 1988)

1989 Breeding Season
A female was first observed doing courtship flying on April 7. One week later a pair were present and copulation was observed opposite the most easterly nest hole. From April 14 through May 22, falcons were observed on several occasions but there was no evidence of a nest attempt. When we attempted to trap the birds they were totally indifferent and simply left the area.

Disturbance
Trucks and men walking at the river edge were observed April 1 roughly 100m from the nest site and on the opposite side of the river. The back hoe arrived the next day and intensive activity was still ongoing April 7 with men active and clearly visible around the pumping station that had been set up. When I returned on April 14 the intensive activity appeared to have ceased and the pumphouse is now only visited for short periods, apparently on a daily basis.

Results
No serious attempt was made to nest in 1989, possibly as a result of unacceptable disturbance during the initiation of the breeding cycle.

Mercury Nest Site - #45 (Young et al.,1986)

History
This is one of the original nest sites documented in the late 1960's and monitored by CWS through the early 1980's. It is named "Mercury" because this nest had the highest level of mercury contamination of any Prairie Falcon nest sites sampled in Alberta in the late 1960's.

The nest was reported to be occupied in 1986 and 1987 (Young, 1988)

1989 Breeding Season (4 young fledged)
A pair of birds on territory March 9 and observed repeatedly throughout the remainder of the breeding season. The female was first observed incubating on April 14 and the first small young observed May 22. Both adults were trapped and banded on that day. Four young were banded June 19 and all four were fledged and observed perched near the site on July 6.

Disturbance
This pair is clearly habituated to the activity associated with the camp which is approximately 1km to the north on the opposite side of the river. They do not pay any attention to moving vehicles on the road a mere 150m away on the opposite side of the river, nor do they react to the presence or activity of the heavy equipment moving on or in association with the rock pile that is adjacent to

the nest site. The first indication of disturbance was observed in April when fisheries biologists began working on the river in front of the nest. The birds were clearly agitated and flew overhead cacking continuously. However, the pair did not desert even though this activity continued for a few hours most days. My last observation of the fisheries biologists was made on May 2 with the female incubating. The only other major disturbance that was observed was on May 22 when some heavy equipment became stuck on the riverbank opposite the nest. Several additional pieces of equipment came to assist and several men were observed walking around the equipment. The birds appeared to have little concern other than to watch the proceedings.

Results - 4 young were fledged

Dam Nest Site - Powerline Site (CWS files), #42 (Young et al.,1986)

History
This is one of the original nest sites documented in the late 1960's and monitored by CWS through the early 1980's. The territory was reported to be occupied by a single adult in 1986. (Young,1986)

1989 Breeding Season
On March 24 first a single female then the pair was observed perched on the cliff opposite the original nest site. The female was observed sitting briefly in the artificial hole on the northeast side of the cliff. Courtship activity and nest displays observed on March 30 on the same cliff. The birds were then observed departing from the cliff during a period of intense disturbance on March 30. They were present on the following two mornings only to depart when the workmen arrived. No birds were observed again until a single female was observed on the cliff April 14. No further observations were made of birds at this cliff.

Disturbance
This pair of birds appear to be habituated to an incredible amount of disturbance including blasting less than 1km from the cliff, heavy equipment and trucks driving underneath the nest at a distance of about 50m and men walking around daily at about 1km from the nest site. Despite this they were not able to tolerate intense activity and the presence of human walking directly under the nest cliff at a distance of about 35m. At first the female did remain on the cliff and watch the activity but soon was forced to leave the area. For three days the birds returned each morning to the site but left when the workmen arrived. When I returned to the site three days later the pair had deserted the site but were observed in the territory briefly on 11 days later.

Results - No nesting attempted.

Buffalo Jump East Nest Site
Raven site(CWS files), #40(Young et al. 1986)

History
This is one of the original nest sites documented in the late 1960's and monitored by CWS through the early 1980's. The territory was reported to be occupied in 1986 and again in 1987.

1989 Breeding Season
The pair were observed in close association at the east end of the Buffalo Jump Cliff on April 2. A third bird which appeared to be a female was also observed near the fence line. The following day two pair were observed, with the fence line the rough demarkation of the territories. On April 6 a single male was present and was observed going into nest holes with both females. On the 14th the three birds were again present but the male now appeared to be attached to the eastern territory. The female appeared to be incubating by May 10 and is noted to be very shy. The two adults were trapped and banded May 17th and the four young caught and banded on June 20th.

Disturbance
Disturbance to this pair was minimal and other than our visits it is doubtful that these birds had any contact with humans. The nearest road is .7km to the southeast and the traffic does not seem to influence the pair at all.

Results - 4 young fledged

Buffalo Jump West Nest Site

History
This is a new nesting territory and results from the splitting of a long established territory at the Buffalo Jump Cliff.

1989 Breeding Season
A female was first observed here on April 1 at the same time as the pair were noted at the east end of the cliff. The situation was very confused as only three birds were observed on most visits. Courtship feeding,nest ledge behaviour and attempted copulation observed by the one male with both females. A second male was observed with this bird on April 3 and again on May 2. The female was flushed from the nest ledge where she was incubating three eggs on May 22. On June 19 no birds were present at the west end of the cliff. The three eggs remained in the nest but were cold and were found to be addled.

Disturbance
Disturbance to this pair was minimal and other than our visits it is doubtful that these birds had any contact with humans. The nearest road is .7km to the southeast and the traffic does not seem to influence the pair at all.

Results - infertile eggs resulting in nest failure.

Bitango Bridge Nest Site - #37 (Young et al.,1986)

History
This is a new nesting territory not occupied in the 1960's. The territory is first described by Young (Young et al.,1986)

1989 Breeding Season
The pair were first observed on territory March 8 and were subsequently observed at every visit. Some courtship activity and a food transfer observed on March 23. The female was flushed from the nest on May 1st where she had apparently been incubating. The female was trapped and banded on May 1. Five young were caught and banded on June 18.

Disturbance
This pair were subjected to considerable disturbance and habitat alteration. Apparently the timing of the most severe disturbance was such that the birds were able to tolerate it. Tree removal took place prior to the breeding season and the bulk of the heavy equipment and gravel removal well into incubation and the rearing of young. In addition to this there was considerable human activity in the form of picnickers, and fishermen near the bridge and occasionally opposite the nest site itself. In general the pair were shy and nest success can best be attributed to the timing of the various activities.

Results - 5 young fledged

Tennessee Creek Nest Site

History
This territory was first identified in 1989 when a female was flushed late in the breeding season. The condition of the nest site and the large accumulation of guano indicates that the territory is an old one with many years of occupancy.

1989 Breeding Season
On June 18th a female was flushed from the side of a cliff adjacent to a well used nest site. The female was clearly territorial, cacked at our presence and circled overhead for a short period before leaving the area. She was observed circling at a distance and then returned to the site as soon as we moved off.

Disturbance
Disturbance at this site would be minimal.

Lang Nest Site

History
This is a new site first recorded in 1989

1989 Breeding Season
Three birds were observed at the site on March 31 and again on April 1. Nest ledge displays and courtship flying observed, the third bird just seemed to be staying in the area. Copulation observed on April 7 and the female appeared to be incubating on May 1st. The female was trapped on May 21 . The nest was checked again on June 18 and it contained one egg, a broken egg and a two-week old youngster. This bird was later banded on July 1.

Disturbance
Disturbance at this site would have been only moderate with a few fishermen about .5km upstream in June and some woodcutting downstream in May.

Results - 1 young fledged

Welsch Nest Site - #22 (Young et al. 1986)

History
This site was first documented by Young (Young et al. 1986) in 1985.

1989 Breeding Season
The pair were first observed at the site March 9 and both birds were observed on most visits to the site. Other than a hint of courtship flying no other courtship activity was observed. The female was observed at the entrance of the nest hole on several occasions and appeared to be incubating on April 15. The pair were trapped and banded on May 21 and 4 young were caught and banded June 18. The young fledged successfully.

Disturbance
At the beginning of the breeding season disturbance was minimal. Although the main road was approximately 150m from the nest site the nest was on a cliff facing away from the road and the birds were largely unaffected by traffic. On April 5 heavy earthmoving equipment was observed working about 2km. to the north and there was some evidence of activity on the hill above and behind the nest site. By April 7th the activity had accelerated and the earthmoving equipment was now dumping material above and behind the site. The activity was continuous, with the noisy earth moving equipment visible to the birds the majority of the time. When revisited on April 13 the activity was unabated and by the presence of the lights apparently was ongoing round the clock. The pair are still present and apparently incubating. The male was observed to fly in literally through the dust and land at the south end of the cliff. Some of the material that has been moved has actually been dumped so that it has come down the side of the cliff less than 50m to the north of the nest. The activity is very, very noisy and virtually continuous however, there are seldom people walking around and the birds do not seem to be overly concerned by the activity and noise. By May 1st construction work appeared to be completed. No additional activity was observed in direct association with the nest until July 7 when the earth moving equipment began to level an area directly opposite the nest site. The young fledged and moved off to the north.

Results - 4 young fledged

Day Nest Site

History
This is a new territory apparently occupied for the first time in 1989. A single bird was observed in this territory in 1988 and the pair were first observed in 1989 investigating a new artificial nest site. They chose a ledge about 50m to the north of the artificial nest hole.

1989 Breeding Season
On March 31st three birds were observed flying over the cliffs, one bird believed to be the female was observed at several ledges and the artificial nest hole. Courtship flying and copulation was then observed on April 7th. However, following this no birds were in evidence for several days and it appeared that the birds had left the cliff. Finally the head of the incubating female was observed on a very small ledge about 50m to the north of the hole. Both adults were trapped and banded on May 22. They were incubating five eggs. Three young were hatched, one disappeared and the remaining two were caught, banded and fledged.

Disturbance
Disturbance at this site was minimal throughout the nesting season.

Results - 2 young fledged

Double Ox-Bow Nest Site - # 18 (Young et al., 1986)

History
This territory was first described by Young (Young et al., 1986) and apparently was first located in 1985.

1989 Breeding Season
The pair was first observed on April 15th. They were very placid and I could not decide if there was any nesting activity. This behaviour was also observed on my next visit several weeks later. On May 22 the female was flushed from the nest where it appeared she had been incubating. The female was very aggressive and was trapped and banded. The male could not be caught. When we returned to band young the nest was empty and both adults flew off silently suggesting a nest failure.

Disturbance
Disturbance at this site would be minimal as it is very difficult to visit.

Results - nest failure.

Horseshoe Canyon Nest Site - #15 (Young et al.,1989)

History
Either this territory or Maloffs was reported to have been a historical Peregrine Falcon nesting territory, however neither were occupied when checked in the 1960's and 1970's. It was first recorded by Young (Young et.al.,1986) and apparently was occupied by Prairie Falcons in 1985.

1989 Breeding Season
A single bird was observed entering the Canyon on March 9 and a pair were observed on territory the following day. I was unable to visit the site until mid April however, no birds were observed from the opposite side of the river. On April 14 the female was flushed from the nest and was joined by the male. The pair remained nearby, they were relatively shy and silent. When we tried to trap the adults they ignored the owl and remained shy and relatively quiet. Four young were banded on June 18 and fledged young were observed in the area early in July.

Disturbance
Disturbance at this site would have been minimal.

Results - 4 young fledged

Maloff Nest Site # 12 (Young et al.,1986)

History
Either this territory or the Horseshoe Canyon site was reported to have been an historical Peregrine Falcon nesting territory, however, neither were occupied when checked in the 1960's and 1970's. This site was first recorded by Young (Young et.al.,1986) and apparently was occupied by Prairie Falcons in 1985.

1989 Breeding Season
The pair were first observed on territory on March 9 and one or both were present on every subsequent visit to the site. The birds appeared to ignore the heavy equipment and men working about .5km to the west near the end of March. The female appeared to be incubating early in May. The male was trapped and banded on May 21st and an unsuccessful attempt was made to catch the female on the 24th. At the time there was one newly hatched chick and three unhatched eggs in the nest. It was a bitterly cold day and we gave up on our trapping attempt because we were concerned for the chick. Unfortunately the nestling subsequently died and the other eggs which failed to hatch appeared to be addled.

Disturbance
This pair of birds were habituated to a moderate amount of disturbance each breeding season just with the normal activity at the farm opposite the nest cliff. However, when this disturbance patter accelerated with the earth moving equipment they were apparently unconcerned and no unusual behaviour was observed.

Result - nest failure.

Castle Dairy Nest Site

History
This is a new site in an artificial nest hole which had been constructed earlier in the year.

1989 Breeding Season
A female prairie that appeared to be in first year plumage was first observed on the cliff on May 1st. The bird acted territorial and was observed to perch near a hole just to the east of the raven nest. By May 10th the female appeared to be incubating and sat very close when I drove up to a point directly opposite the nest. We tried unsuccessfully to trap the female on May 21st however we were able to trap and band the male on the 24th and found the nest to contain 5 unhatched eggs. Four young were caught and banded on July 1st. They were observed again on July 7 and appeared ready to leave the nest.

Disturbance
This pair experienced minimal to moderate disturbance primarily from the activity of people on the opposite side of the river. There was some evidence of picnicking and fishermen were on the river for much of the month of June.

Results - 4 young fledged.

Fairbrother Nest Site

History
This is one of the original nest sites documented in the late 1960's and monitored by CWS through the early 1980's. This site was not included by Young (Young et al.,1986) presumably because it is approximately 3km from the construction area and will not be affected by either the construction or flooding. I have included it because of its relative proximity and the fact that there is considerable interaction between these birds and those that will be affected by the dam.

1989 Breeding Season

A single bird was observed at the site on March 8th and 9th. The first observation of a second bird was made on the 23rd and then again on the 24th. Courtship activity was observed. The male was observed defending the territory against a Golden Eagle on April 6th. A single egg was found in the nest on April 15th. Five eggs were in the nest at the next visit when we trapped and banded the adult birds. Three young were caught and banded on June 19th and were later observed fully fledged flying along the cliff face.

Disturbance

This pair would have be subjected to a minimal amount of disturbance by virtue of the sites relative inaccessibility.

Results - 3 young fledged.

APPENDIX 2.

RECORDED MIGRANT ARRIVAL DATES

Prairie Falcon *Falco mexicanus*	- March	9
Richardson Merlin *Falco columbarius richardsoni*		9
American Robin *Turdus migratorius*		9
Canada Goose *Branta canadensis*		9
Whistling Swan *Cygne siffleur*		10
Red-tailed Hawk *Buteo jamaicensis*		10
Killdeer *Charadrius vociferus*		25
Goshawk *Accipiter gentilis*		25
California Gull *Larus californicus*		25
American Kestrel *Falco spaverius*		25
Common Merganser *Mergus merganser*		30
Ferruginous Hawk *Buteo regalis*		31
Rough-legged Hawk *Buteo lagopus*		31
Northern Pintail *Anus acuta*	- April	5
Northern Harrier *Circus cyaneus*		5
Clarkes Nutcracker *Nucifraga columbiana*		5
Bohemian Waxwing *Bombycilla garrulus*		5
Great Blue Heron *Ardea herodias*		6
Golden Eagle *Aquila chrysaetos*		6
Red-breasted Merganser *Mergus serrator*		7
Mountain Bluebirds *Sialia currucoides*		7
Northern Rough-winged Swallow *Stelgidopteryx serripennis*		13
Say's Phoebe *Sayornis saya*		14
Wood Duck *Aix sponsa*		15
Common Grackel *Quiscalus quiscula*	- May	1
Swainson Hawk -*Buteo swainsoni*		1
Red-winged Blackbird *Agelaius phoeniceus*		1
Western Meadowlark *Sturnella neglecta*		1
Snow Goose *Chen hyperborea*		1
Belted Kingfisher *Ceryle alcyon*		2
Long-billed Curlew *Numenius americanus*		2
Vesper Sparrow *Pooecetes gramineus*		2
Brown-headed Cowbird *Molothrus ater*		2
Barn Swallow - *Hirundo rustica*		2
Yellow-bellied Sapsucker *Sphyrapicus varius*		10
Ruby-throated Hummingbird *Archilochus colubris*		10
Spotted Sandpiper *Actitis macularia*		10
Willet *Catoptrophorus semipalmatus*		12
Mourning Dove *Zenaida marcroura*		12
Eastern Kingbird *Tyrannus tyrannus*		12
Yellow-rumped Warbler *Dendroica coronata*		12

* Possibly winter resident or visitant

APPENDIX 3.

DEFINITIONS OF TERMS USED IN REPORT

Nesting Territory - The area around a nest site that is normally defended by the pair of birds in residence

Courtship Behaviour - Activities associated with pair formation including the following:

Courtship flying (flight displays)

Nest displays (individual and as pairs)

Nest selection (one of both birds of a pair)

Nest construction (in falcons the scraping a nest hollow)

Food exchanges (where the male brings food to the female)

Copulation or mating attempt

Alternate Nest - A suitable alternate nest site in or adjacent to a nesting territory that is available in the event of failure or loss of a nest site.

Artificial Nest - A man made nest structure or nest hole that has been constructed specifically to provide suitable nest sites for resident breeding birds. In the context of this project artificial nest structures are being constructed for Prairie falcons and Ferruginous hawks and may be utilized by other raptors, geese or ravens.

Foraging Habitat - Habitat associated with a breeding territory that maintains an adequate abundance of accessible prey species.

Young Fledged - the young known to have successfully flown from a nest site.

Disturbance - disturbance is defined as something which disrupts or destroys the peace. In reference to breeding birds disturbance would be any activity which disrupts the breeding cycle. For the sake of discussion and comparison I have referred to disturbance as minimal, moderate, high and severe.

Minimal disturbance would include the incidental transgression of any predator, human,or vehicle into the territory of a breeding pair which may or may not elicit a territorial response. In such an instance, a pair would return to normal behaviour as soon as the transgression ceased.

Moderate disturbance would include frequent transgression of a predator, vehicle, activity or humans in the territory of a breeding pair but at a sufficient distance from the nest site that would not constitute a threat.

High disturbance is excessive disturbance which in my opinion would normally result in the desertion of a nest site for a given breeding season but which are tolerated either as a result of habituation or because the activity occurred relatively late in the breeding cycle.

Severe disturbance includes any activity which is threatening early in the breeding cycle, in particular during courtship and nest site selection. Such disturbance is very likely to result in desertion of a nest site or even a nesting territory for that breeding season.

Habituation - "the waning of a response to a repeated activity" (Marler and Hamilton, 1966) or in this application, the ability of individuals or pairs of birds to accept disturbance as a result of increased exposure to an activity which does not harm or threaten the individual or pair.